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INSTITUTE FOR COMPUTER APPLICATIONS IN SCIENCE AND ENGINEERING
NASA Langley Research Center, Hampton, Virginia 23665

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Introduction

The Institute for Computer Applications in Science and Engineering (ICASE) is operated at the Langley Research Center of NASA by the Universities Space Research Association (USRA) under a contract with the Center. USRA is a non-profit consortium of major U. S. colleges and universities.

The Institute conducts unclassified basic research in applied mathematics, numerical analysis, and computer science in order to extend and improve problem solving capabilities in science and engineering, particularly in aeronautics and space.

ICASE has a small permanent staff. Research is conducted primarily by visiting scientists from universities and industry who have resident appointments for limited periods of time, and by consultants. Members of NASA's research staff also may be resident at ICASE for limited periods.

The major categories of the current ICASE research program are:

a. Numerical methods, with particular emphasis on the developement and analysis of basic numerical algorithms;

b. Control and parameter identification problems, with emphasis on effective numerical methods;

c. Computational problems in engineering and the physical sciences, particularly fluid dynamics, acoustics, structural analysis, and chemistry;

d. Computer systems and software, especially vector and parallel computers, microcomputers, and data management.

ICASE reports are considered to be primarily preprints of manuscripts that have been submitted to appropriate research journals or which are to appear in conference proceedings. In the next section, a complete listing of ICASE reports for the calendar years 1975 through December 1986 are given. The final section contains journal and conference proceedings references for older reports.

ICASE Reports — 1986

Canuto, C. and A. Quarteroni: *On the boundary treatment in spectral methods for hyperbolic systems.* ICASE Report No. 86-1, December 27, 1985, 19 pages. To appear in J. Comput. Phys.

Gottlieb, D., L. Lustman, and E. Tadmor: *Stability analysis of spectral methods for hyperbolic initial-boundary value systems.* ICASE Report No. 86-2, January 16, 1986, 38 pages. To appear in SIAM J. Numer. Anal., Vol. 24, No. 2, April 1987.

Dutt, P.: *A Riemann solver based on a global existence proof for the Riemann problem.* ICASE Report No. 86-3, January 17, 1986, 12 pages. Submitted to J. Comput. Phys. but withdrawn.

Saltz, Joel H., Vijay K. Naik, and David M. Nicol: *Reduction of the effects of the communication delays in scientific algorithms on message passing MIMD architectures.* ICASE Report No. 86-4, January 22, 1986, 26 pages. To appear in SIAM J. Sci. Stat. Comput.

Moitra, A., E. Turkel, and A. Kumar: *Application of a Runge-Kutta scheme for high-speed inviscid internal flows.* ICASE Report No. 86-5, January 31, 1986, 26 pages. AIAA Paper No. 86-0104, AIAA 24th Aerospace Sciences Meeting, January 6-9, 1986, Reno, Nevada.

Eidson, T. M., M. Y. Hussaini, and T. A. Zang: *Simulation of the turbulent Rayleigh-Benard problem using a spectral/finite difference technique.* ICASE Report No. 86-6, February 4, 1986, 43 pages. Proc. EUROMECH 199 Direct and Large Eddy Simulation of Turbulent Flows, Munich, Germany, September 30 - October 2, 1985.

Nicol, David M. and Paul F. Reynolds, Jr.: *An optimal repartitioning decision policy.* ICASE Report No. 86-7, February 10, 1986, 19 pages. IEEE Trans. on Software Engineering.

Gottlieb, D., L. Lustman, and E. Tadmor: *Convergence of spectral methods for hyperbolic initial-boundary value systems.* ICASE Report No. 86-8, January 17, 1986, 15 pages. To appear in SIAM J. Numer. Anal.

Abarbanel, S., A. Bayliss, and L. Lustman: *Non-reflecting boundary conditions for the compressible Navier-Stokes equations.* ICASE Report No. 86-9, March 4, 1986, 26 pages. Invited lecture at the 7th Internat. Conference on Computing Methods in Applied Science and Engineering, December 9-13, 1985, Versailles, France (INRIA).

Hariharan, S. I.: *Nonlinear acoustic wave propagation in atmosphere.* ICASE Report No. 86-10, March 5, 1986, 28 pages. IMACS Proceedings on Computational Acoustics, August, 1986, Yale.

Banks, H. T. and K. A. Murphy: *Quantitative modeling of growth and dispersal in population models.* ICASE Report No. 86-11, March 17, 1986, 13 pages.

Lakin, W. D.: *A combined integrating and differentiating matrix formulation for boundary value problems on rectangular domains*. ICASE Report No. 86-12, March 17, 1986, 30 pages. J. Engrg. Math., Vol. 20, 1986, pp. 203-215.

Iqbal, M. Ashraf, Joel H. Saltz, and Shahid H. Bokhari: *Performance tradeoffs in static and dynamic load balancing strategies*. ICASE Report No. 86-13, March 17, 1986, 24 pages. Proc. of the 1986 Internat. Conf. on Parallel Processing, August 1986, pp. 1040-1047.

Turkel, E.: *Preconditioned methods for solving the incompressible and low speed compressible equations*. ICASE No. 86-14, March 20, 1986, 38 pages. To appear in J. Comp. Phys.

Gibson, J. S. and I. G. Rosen: *Numerical approximation for the infinite-dimensional discrete-time optimal linear-quadratic regulator problem*. ICASE Report No. 86-15, March 20, 1986, 82 pages. Submitted to SIAM J. Cont. Opt.

Gibson, J. S. and I. G. Rosen: *Shifting the closed-loop spectrum in the optimal linear quadratic regulator problem for hereditary systems*. ICASE Report No. 86-16, March 20, 1986, 47 pages. Submitted to IEEE Trans. Auto J. Control.

Shih, Ke-Gang: *On the existence of solutions for an equation arising in the theory of laminar flow in a uniformly porous channel with injection*. ICASE Report No. 86-17, March 21, 1986, 26 pages. To appear in SIAM J. Appl. Math.

South, J. C., Jr. and M. Y. Hussaini, (eds.): *Advances in numerical and applied mathematics*. ICASE Report No. 86-18, March 28, 1986, 597 pages. To appear in Applied Numerical Mathematics.

Lee, Tai-yong, Costas Kravaris, and John H. Seinfeld: *History matching by spline approximation and regularization in single-phase areal reservoirs*. ICASE Report No. 86-19, March 31, 1986, 53 pages. SPE Reservoir Engineering, September 1986, pp. 521-534.

Mac Giolla Mhuiris, Nessan: *The construction and use of divergence free vector expansions for incompressible fluid flow calculations*. ICASE Report No. 86-20, April 15, 1986, 21 pages. To appear in Proceedings of a Spectral Methods Workshop.

Bayliss, A., K. E. Jordan, B. J. LeMesurier, and E. Turkel: *A fourth order accurate finite difference scheme for the computation of elastic waves*. ICASE Report No. 86-21, April 23, 1986, 44 pages. Bulletin of the Seismological Society of America, Vol. 76, No. 4, August 1986, pp. 1115-1132.

Harten, Ami, Bjorn Engquist, Stanley Osher, and Sukumar R. Chakravarthy: *Uniformly high order accurate essentially non-oscillatory schemes III.* ICASE Report No. 86-22, April 29, 1986, 97 pages. To appear in J. Comput. Phys., 1987.

Ta'asan, Shlomo: *Multigrid method for the equilibrium equations of elasticity using a compact scheme.* ICASE Report No. 86-23, April 30, 1986, 25 pages. Submitted to J. Comp. Physics.

Reed, Daniel A., Loyce M. Adams, and Merrell L. Patrick: *Stencils and problem partitionings: Their influence on the performance of multiple processor systems.* ICASE Report No. 86-24, May 2, 1986, 47 pages. To appear in IEEE Trans. Comput.

Hussaini, M. Y. and T. A. Zang: *Spectral methods in fluid dynamics.* ICASE Report No. 86-25, May 5, 1986, 61 pages. Annual Review of Fluid Mechanics, Vol. 19, 1987.

Hussaini, M. Y., W. D. Lakin, and A. Nachman: *On similarity of a boundary layer problem with an upstream moving wall.* ICASE Report No. 86-26, May 9, 1986, 25 pages. To appear in SIAM J. Appl. Math.

Chen, T. F. and G. J. Fix: *Least squares finite element simulation of transonic flows.* ICASE Report No. 86-27, May 9, 1986, 28 pages. Submitted to Applied Numerical Mathematics.

Kopriva, David: *A spectral multidomain method for the solution of hyperbolic systems.* ICASE Report No. 86-28, May 9, 1986, 47 pages. Applied Numerical Mathematics, Vol. 2, 1986, pp. 221-241.

Ta'asan, Shlomo: *Multigrid method for a vortex breakdown simulation.* ICASE Report No. 86-29, May 9, 1986, 22 pages. Applied Numerical Mathematics, Vol. 2, 1986, pp. 303-311.

Gunzburger, M. D. and R. A. Nicolaides: *On structuring algorithms and solution techniques for the numerical approximation of partial differential equations.* ICASE Report No. 86-30, May 9, 1986, 32 pages. Applied Numerical Mathematics, Vol. 2, 1986, pp. 243-256.

Strikwerda, J. C., B. A. Wade, and K. P. Bube: *Regularity estimates up to the boundary for elliptic systems of difference equations.* ICASE Report No. 86-31, May 8, 1986, 65 pages. Submitted to SIAM J. Numer. Anal.

Burns, J. A., E. M. Cliff, and R. K. Powers: *Computational methods for the control of distributed parameter systems.* ICASE Report No. 86-32, May 12, 1986, 18 pages. Submitted to Proc. of the 24th IEEE Conf. on Decision and Control.

Tadmor, Eitan: A *minimum entropy principle in the gas dynamics equations.* ICASE Report No. 86-33, May 20, 1986, 20 pages. Applied Numerical Mathematics, Vol. 2, 1986, pp. 211-219.

Mac Giolla Mhuiris, Nessan: *Calculations of the stability of some axisymmetric flows proposed as a model of vortex breakdown.* ICASE Report No. 86-34, May 20, 1986, 36 pages. Submitted to Applied Numerical Mathematics.

Speziale, Charles G.: *On the advantages of the vorticity-velocity formulation of the equations of fluid dynamics.* ICASE Report No. 86-35, May 20, 1986, 10 pages. Submitted to Applied Numerical Mathematics.

South, Jerry C., Jr., Mohammed M. Hafez, and David Gottlieb: *Stability analysis of intermediate boundary conditions in approximate factorization schemes.* ICASE Report No. 86-36, May 20, 1986, 27 pages. Applied Numerical Mathematics, Vol. 2, 1986.

Swanson, R. C. and E. Turkel: *Pseudo-time algorithms for the Navier-Stokes equations.* ICASE Report No. 86-37, May 21, 1986, 32 pages. Submitted to Applied Numerical Mathematics.

Banks, H. T. and D. W. Iles: *On compactness of admissible parameter sets: Convergence and stability in inverse problems for distributed parameter systems.* ICASE Report No. 86-38, June 9, 1986, 16 pages. To appear in Proc. IFIP Conf. on Control Systems Governed by Partial Differential Equations.

Erlebacher, Gordon and Yousuff Hussaini: *Incipient transition phenomena in compressible flows over a flat plate.* ICASE Report No. 86-39, June 10, 1986, 21 pages. Proc. 10th Inter. Conf. on Numer. Methods in Fluid Dynamics, June 1986.

Iqbal, M. Ashraf: *Approximate algorithms for partitioning and assignment problems.* ICASE Report No. 86-40, June 10, 1986, 16 pages. Submitted to IEEE Trans. Computers.

Bokhari, Shahid: *Multiprocessing the sieve of Eratosthenes.* ICASE Report No. 86-41, June 17, 1986, 26 pages. To appear in IEEE Computer, 1987.

Nicolaides, R. A.: *Construction of higher order accurate vortex and particle methods.* ICASE Report No. 86-42, June 13, 1986, 20 pages. Submitted to Applied Numerical Mathematics.

Lamm, Patricia K. and Katherine A. Murphy: *Estimation of discontinuous coefficients and boundary parameters for hyperbolic systems.* ICASE Report No. 86-43, June 18, 1986, 39 pages. Submitted to Quart. Appl. Math.

Goldberg, Moshe and Eitan Tadmor: *Convenient stability criteria for difference approximations of hyperbolic initial-boundary value problems II.* ICASE Report No. 86-44, June 25, 1986, 38 pages. Submitted to Math. Comp.

Nicol, David M. and Joel H. Saltz: *Dynamic remapping of parallel computations with varying resource demands.* ICASE Report No. 86-45, July 18, 1986, 55 pages. Submitted to IEEE Trans. Comput.

Saltz, Joel H. and David M. Nicol: *Statistical methodologies for the control of dynamic remapping*. ICASE Report No. 86-46, July 8, 1986, 33 pages. Submitted to Proceeding ARO.

Poore, Aubrey B.: *The expanded Langrangian system for constrained optimization problems*. ICASE Report No. 86-47, July 9, 1986, 29 pages. Submitted to SIAM J. Control Optim.

Maestrello, Lucio, Alvin Bayliss, Paresh Parikh, and Eli Turkel: *Stability and control of compressible flows over a surface with concave-convex curvature*. ICASE Report No. 86-48, July 9, 1986, 34 pages. Submitted to J. Fluid Mech.

Rosenfeld, M., M. Israeli, and M. Wolfshtein: *A numerical study of separation on a spheroid at incidence*. ICASE Report No. 86-49, July 11, 1986, 35 pages. To appear in AIAA.

Sidi, Avram and Moshe Israeli: *Numerical quadrature methods for integrals of singular periodic functions and their application to singular and weakly singular integral equations*. ICASE Report No. 86-50, July 16, 1986, 35 pages. Submitted to SIAM J. Numer. Anal.

Lustman, Liviu R. and Milton E. Rose: *A three dimensional calculation of elastic equilibrium for composite materials*. ICASE Report No. 86-51, July 24, 1986, 28 pages. Submitted to Inernat. J. Numer. Methods Engrg.

Hariharan, S. I. and S. I. Sudharsanan: *Wave envelope technique for multimode wave guide problems*. ICASE Report No. 86-52, July 30, 1986, 29 pages. Submitted to Applied Numerical Mathematics.

Nicol, David M.: *Optimal partitioning of random programs across two processors*. ICASE Report No. 86-53, August 1, 1986, 26 pages. Submitted to IEEE Trans. Software Engrg.

Jordan, Harry F.: *The force on the Flex: Global parallelism and portability*. ICASE Report No. 86-54, August 5, 1986, 21 pages. To appear in Parallel Processing and Medium Scale Multiprocessors, Arthur Wouk (Editor), SIAM, Philadelphia, 1987.

Nicol, David M.: *Expected performance of m-solution backtracking*. ICASE Report No. 86-55, August 5, 1986, 25 pages. Submitted to SIAM J. Comput.

Jackson, T. L.: *Effect of thermal expansion on the stability of two-reactant flames*. ICASE Report No. 86-56, August, 18, 1986, 13 pages. Submitted to Combined Science and Technology.

Hussaini, M. Y.: *Recent developments in spectral methods*. ICASE Report No. 86-57, August 29, 1986, 19 pages. To appear in Proc. 10th Inter. Conf. Numer. Meth. in Fluid Dynamics, Springer-Verlag.

Nicol, David M. and Paul F. Reynolds: *Dynamic remapping decisions in multi-phase parallel computations.* ICASE Report No. 86-58, September 8, 1986, 47 pages. Submitted to IEEE Trans. Comput.

Streett, C. L. and M. Y. Hussaini: *Finite length effects in Taylor-Couette Flow.* ICASE Report No. 86-59, September 9, 1986, 30 pages. To appear in Proc. Workshop on "The Stability of Time-Dependent/Spatially Varying Flows," Springer-Verlag.

Solomonoff, A. and E. Turkel: *Global collocation methods for approximation and the solution of partial differential equations.* ICASE Report No. 86-60, September 17, 1986, 67 pages. Submitted to J. Comput. Physics.

Bernardi, Christine, Claudio Canuto, and Yvon Maday; *Generalized inf-sup condition for Chebyshev approximation of the Navier-Stokes equations.* ICASE Report No. 86-61, November 7, 1986, 67 pages. Submitted to SIAM J. Numer. Anal.

Gunzburger, M. D.: *Mathematical aspects of finite element methods for incompressible viscous flows.* ICASE Report No. 86-62, September 18, 1986, 46 pages. Submitted to Finite Element Theory and Application, Springer-Verlag.

LeVeque, Randall J. and Lloyd N. Trefethen: *Fourier analysis of the SOR iteration.* ICASE Report No. 86-63, September 30, 1986, 9 pages. Submitted to SIAM J. Numer. Anal.

Dutt, Pravir and Shlomo Ta´asan: *A spline-based parameter estimation technique for static models of elastic structures.* ICASE Report No. 86-64, October 8, 1986, 33 pages. Submitted to Math. Comp.

Ta´asan, Shlomo and Pravir Dutt: *Parameter estimation problem for distributed systems using a multigrid method.* ICASE Report No. 86-65, October 8, 1986, 19 pages. Submitted to J. Comput. Physics.

Myers, Thomas J. and Maya B. Gokhale: *Parallel scheduling of recursively defined arrays.* ICASE Report No. 86-66, October 3, 1986, 26 pages. Submitted to J. Sym. Comp.

Gokhale, Maya B.: *PS: A nonprocedural language with data types and modules.* ICASE Report No. 86-67, October 3, 1986, 20 pages. Submitted to J. Sym. Comp.

Napolitano, M. and J. H. Morrison: *Efficient solutions of two-dimensional incompressible steady viscous flows.* ICASE Report No. 86-68, October 16, 1986, 46 pages. Submitted to Comput. & Fluids.

Harten, A.: *On the nonlinearity of modern shock-capturing schemes.* ICASE Report No. 86-69, October 17, 1986, 62 pages. To appear in Proc. of "Wave Motion: Theory, modeling, and computations," U.C. Berkeley, June 9-12 1986, Springer-Verlag.

Banks, H. T. and I. G. Rosen: *Computational methods for the identification of spatially varying stiffness and damping in beams.* ICASE Report No. 86-70, October 22, 1986, 42 pages. To appear in Control: Theory and Advanced Technology.

Banks, H. T., S. S. Gates, I. G. Rosen, and Y. Wang: *The identification of a distributed parameter model for a flexible structure.* ICASE Report No. 86-71, October 22, 1986, 43 pages. Submitted to SIAM J. Control Optim.

Gibson, J. S. and I. G. Rosen: *Computational methods for optimal linear-quadratic compensators for infinite dimensional discrete-time systems.* ICASE Report No. 86-72, October 22, 1986, 25 pages. Submitted to Proc. of the Conf. on the Control and Identification of Distributed Parameter Systems, Vorau, Austria.

Bennett, J. and P. Hall: *On the secondary instability of Taylor-Görtler vortices to Tollmien-Schlichting waves in fully-developed flows.* ICASE Report No. 86-73, November 17, 1986, 46 pages. Submitted to J. Fluid Mech.

Tadmor, E.: *Convenient total variation diminishing conditions for nonlinear difference schemes.* ICASE Report No. 86-74, November 18, 1986, 32 pages. To appear in SIAM J. Numer. Anal.

Roe, P. L.: *Remote boundary conditions for unsteady multidimensional aerodynamic computations.* ICASE Report No. 86-75, November 18, 1986, 26 pages. Submitted to J. Comput. Phys.

Banks, H. T. and K. Ito: *A numerical algorithm for optimal feedback gains in high dimensional LQR problems.* ICASE Report No. 86-76, November 18, 1986, 31 pages. Submitted to SIAM J. Control Optim.

Temam, Roger: *Survey of the status of finite element methods for partial differential equations.* ICASE Report No. 86-77, November 18, 1986, 63 pages. Submitted to the Proceedings of the Finite Element Workshop at Hampton, Virginia, Springer-Verlag.

Nicolaides, R. A. and Shenaz Choudhury: *Iterative methods for elliptic finite element equations on general meshes.* ICASE Report No. 86-78, November 25, 1986. Submitted to the Proceedings of the Finite Element Workshop at Hampton, Virginia, Springer-Verlag.

Ma, C. C. H.: *Inherent stability robustness of adaptive control systems.* ICASE Report No. 86-79, November 14, 1986, 39 pages. Submitted to Control Theory and Advanced Technology.

Brenier, Yann and Stanley Osher: *The discrete one-sided Lipschitz condition for convex scalar conservation laws.* ICASE Report No. 86-80, November 25, 1986, 33 pages. Submitted to SIAM J. Numer. Anal.

Adams, Loyce, Randy LeVeque, and David Young: *Analysis of the SOR iteration for the 9-point Laplacian.* ICASE Report No. 86-81, December 8, 1986, 40 pages. Submitted to SIAM J. Numer. Anal.

Kopriva, David A.: *A practical assessment of spectral accuracy for hyperbolic problems with discontinuities.* ICASE Report No. 86-82, December 9, 1986, 22 pages. Submitted to J. Comp. Phys.

Hall, Philip: *The nonlinear development of Gortler vortices in growing boundary layers.* ICASE Report No. 86-83, December 9, 1986, 52 pages. Submitted to J. Fluid Mech.

ICASE Reports: 1985

Ortega, J. M. and R. G. Voigt: *Solution of partial differential equations on vector and parallel computers.* ICASE Report No. 85-1, January 2, 1985, 173 pages. SIAM Review, Vol. 27, No. 2, June 1985, pp. 149-240.

Voigt, R. G.: *Where are the parallel algorithms?,* ICASE Report No. 85-2, January 16, 1985, 14 pages. 1985 National Computer Conference Proceedings, AFIPS Press, Reston, VA, pp. 329-334.

Gottlieb, D. and E. Tadmor: *Recovering pointwise values of discontinuous data within spectral accuracy.* ICASE Report No. 85-3, January 31, 1985, 20 pages. Progress and Supercomputing in Computational Fluid Dynamics, (E. M. Murman and S. S. Abarbanel, eds.), Birkhauser Boston, Inc., 1985, pp. 357-375.

Noonan, R. E.: *An algorithm for generating abstract syntax trees.* ICASE Report No. 85-4, January 31, 1985, 18 pages. Computer Languages, Vol. 10, No. 3-4, 1985, pp. 225-236.

Lakin, W. D.: *Differentiating matrices for arbitrarily spaced grid points.* ICASE Report No. 85-5, January 31, 1985, 23 pages. Internat. J. Numer. Methods Engrg., Vol. 23, 1986, pp. 209-218.

Fleming, P. J.: *SUBOPT - A CAD program for suboptimal linear regulators.* ICASE Report No. 85-6, February 4, 1985, 16 pages. Proc. Institute of Measurement and Control Workshop on Computer-Aided Control System Design, Brighton, England, September 1984, pp. 13-20.

Banks, H. T. and I. G. Rosen: *A Galerkin method for the estimation of parameters in hybrid systems governing the vibration of flexible beams with tip bodies.* ICASE Report No. 85-7, February 5, 1985, 44 pages.

Tal-Ezer, H.: *The eigenvalues of the pseudospectral Fourier approximation to the operator* $\sin(2x) \frac{\partial}{\partial x}$. ICASE Report No. 85-8, February 7, 1985, 10 pages. Submitted to Math. Comp.

Tal-Ezer, H.: *Spectral methods in time for parabolic problems*. ICASE Report No. 85-9, February 8, 1985, 19 pages. To appear in SIAM J. Numer. Anal.

Tadmor, E.: *Complex symmetric matrices with strongly stable iterates*. ICASE Report No. 85-10, February 14, 1985, 22 pages. To appear in Linear Algebra and Appl., Vol. 78, 1986, pp. 65-77.

Turkel, E.: *Algorithms for the Euler and Navier-Stokes equations for supercomputers*. ICASE Report No. 85-11, February 14, 1985, 27 pages. Progress and Supercomputing in Computational Fluid Dynamics, (E. M. Murman and S. S. Abarbanel, eds.), Birkhauser Boston, Inc., 1985, pp. 155-172.

Pratt, T. W.: *PISCES: an environment for parallel scientific computation*. ICASE Report No. 85-12, February 15, 1985, 30 pages. IEEE Trans. Software Engrg., Vol. 2, No. 4, July 1985, pp. 7-20.

Harabetian, E.: *A convergent series expansion for hyperbolic systems of conservation laws*. ICASE Report No. 85-13, February 20, 1985, 88 pages. Trans. Amer. Math. Soc., Vol. 294, No. 2, April 1986, pp. 383-425.

Abarbanel, S. and D. Gottlieb: *Information content in spectral calculations*. ICASE Report No. 85-14, February 21, 1985, 13 pages. Progress and Supercomputing in Computational Fluid Dynamics, (E. M. Murman and S. S. Abarbanel, eds.), Birkhauser Boston, Inc., 1985, pp. 345-356.

Cox, C. L. and G. J. Fix: *On the accuracy of least squares methods in the presence of corner singularities*. ICASE Report No. 85-15, February 21, 1985, 24 pages. Comput. Math. Appl., Vol. 10, No. 6, 1985, pp. 463-475.

Noonan, R. E. and W. R. Collins: *Construction of a menu-based system*. ICASE Report No. 85-16, February 26, 1985, 11 pages. Submitted to Software Practice and Experience.

Maday, Y.: *Analysis of spectral operators in one-dimensional domains*. ICASE Report No. 85-17, February 28, 1985, 26 pages. Submitted to Math. Comp.

Roe, P. L.: *Discrete models for the numerical analysis of time-dependent multidimensional gas dynamics*. ICASE Report No. 85-18, March 1, 1985, 36 pages. J. Comput. Phys., Vol. 63, No. 2, April 1986, pp. 458-476.

Zang, T. A. and M. Y. Hussaini: *A three-dimensional spectral algorithm for simulations of transition and turbulence*. ICASE Report No. 85-19, March 6, 1985, 39 pages. AIAA Paper No. 85-0296 presented at the AIAA 23rd Aerospace Sciences Meeting, January 14-17, 1985, Reno, Nevada.

Drummond, J. P., M. Y. Hussaini, and T. A. Zang: *Spectral methods for modeling supersonic chemically reacting flow fields*. ICASE Report No. 85-20, March 8, 1985, 37 pages. AIAA J.

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Rosen, I. G.: *Spline-based Rayleigh-Ritz methods for the approximation of the natural modes of vibration for flexible beams with tip bodies.* ICASE Report No. 85-22, March 18, 1985, 31 pages. Quarterly of Applied Mathematics, Vol. XLIV, No. 1, April 1986, pp. 169-185.

Bayliss, A., L. Maestrello, P. Parikh, and E. Turkel: *Numerical simulation of boundary layer excitation by surface heating/cooling.* ICASE Report No. 85-23, March 25, 1985, 22 pages. AIAA Paper No. 85-0565, AIAA Shear Flow Control Conference, March 12-14, 1985, Boulder, CO. AIAA J., Vol. 24, pp. 1095-1101, 1986.

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Davis, S. F.: *Shock capturing.* ICASE Report No. 85-25, April 26, 1985, 23 pages. To appear in Numerical Methods for Partial Differential Equations, (S. I. Hariharan and T. H. Moulden, eds.), Pitman Press, 1986.

Brandt, A. and S. Ta'asan: *Multigrid solutions to quasi-elliptic schemes.* ICASE Report No. 85-26, May 10, 1985, 21 pages. Progress and Super-computing in Computational Fluid Dynamics, (E. M. Murman and S. Abarbanel, eds.), Birkhauser Boston, Inc., 1985, pp. 235-255.

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Mehrotra, P. and J. Van Rosendale: *The BLAZE language: A parallel language for scientific programming.* ICASE Report No. 85-29, May 15, 1985, 57 pages. To appear in Parallel Computing.

Trefethen, L. N. and L. Halpern: *Well-posedness of one-way wave equations and absorbing boundary conditions.* ICASE Report No. 85-30, June 10, 1985, 23 pages. Math. Comp., Vol. 47, 1986, pp. 421-435.

Majda, G.: *A new theory for multistep discretizations of stiff ordinary differential equations: Stability with large step sizes.* ICASE Report No. 85-31, June 11, 1985, 70 pages. Math. Comp., Vol. 47, No. 176, October 1986, pp. 473-502.

Banks, H. T.: *On a variational approach to some parameter estimation problems.* ICASE Report No. 85-32, June 18, 1985, 38 pages. Invited lecture, Internationl Conference on Control Theory for Distributed Parameter Systems and Applications, July 9 - 14, 1984, Voran, Austria.

Hariharan, S. I.: *Absorbing Boundary Conditions for Exterior Problems.* ICASE Report No. 85-33, July 16, 1985, 33 pages. Numerical Methods for Partial Differential Equations, (S. I. Hariharan and T. H. Moulden, eds.), Pitman Press, 1986.

Rosenau, P. and E. Turkel: *Long-time asymptotics of a system for plasma diffusion.* ICASE Report No. 85-34, July 23, 1985, 18 pages. To appear in special issue of Transport Theory and Statistical Physics.

Adams, L.: *Reordering computations for parallel execution.* ICASE Report No. 85-35, July 24, 1985, 18 pages. Comm. Appl. Numer. Meths., Vol. 2, No. 3, May-June 1986, pp. 263-272.

Noonan, R. E. and W. R. Collins: *The parser generator as a general purpose tool.* ICASE Report No. 85-36, July 31, 1985, 35 pages. Submitted to Computing Surveys.

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Saltz, J. H. and V. K. Naik: *Towards developing robust algorithms for solving partial differential equations on MIMD machines.* ICASE Report No. 85-39, August 10, 1985, 51 pages. Submitted to Parallel Computing.

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14

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32

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